U.S. Forest Service

RESEARCH NOTE

CENTRAL STATES FOREST EXPERIMENT STATION
COLUMBUS, OHIO R. D. LANE, DIRECTOR

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PLANT LARGE BLACK WALNUT SEEDLINGS FOR BEST SURVIVAL AND GROWTH

Early results from five experimental black walnut (*Juglans nigra* L.) plantations in Indiana show that large-diameter walnut seedlings survive better and grow faster than small ones on cleared forest sites (fig. 1) and, especially, on coal strip-mined banks. These results corroborate similar work done with shortleaf pine (*Pinus echinata* Mill.).[1/2/] The study, begun in 1960, was established and maintained with the cooperation of the Forestry Division of the Indiana Department of Conservation, the Mid-West Coal Association, Purdue University, and the Wayne-Hoosier National Forest.

The Study

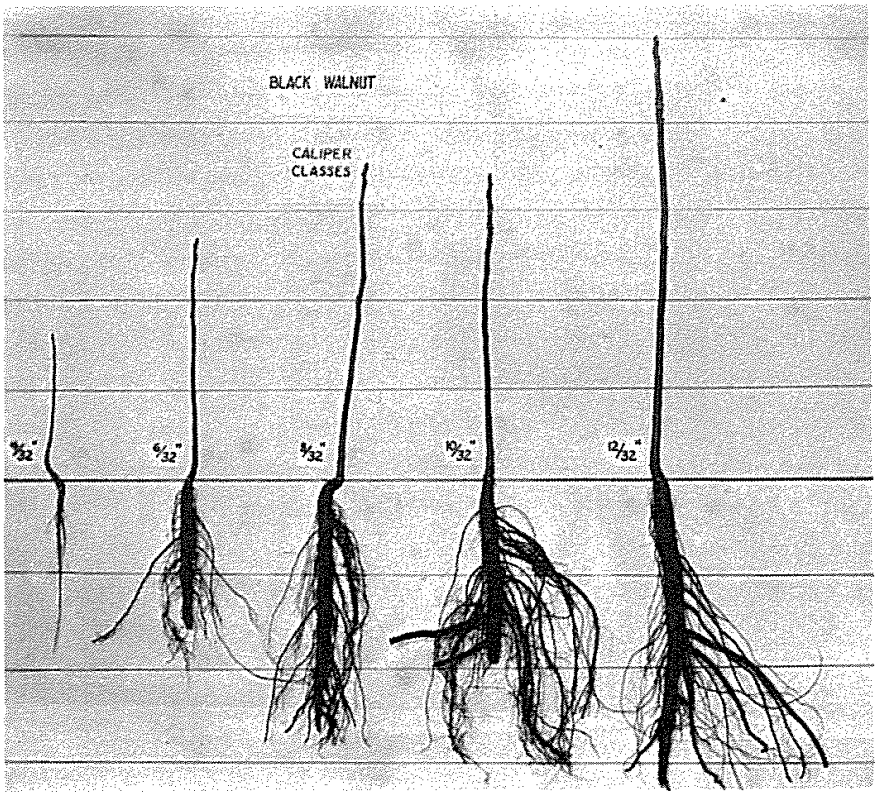
From 1960 to 1962 graded 1-0 black walnut seedlings from Indiana's Jasper-Pulaski State Nursery were planted at five different locations in Indiana: cleared forest sites near Paoli, Bedford, Mitchell, and Darlington, and coal strip-mined land near Lynnville. Seedlings used were graded into five, 2/32-inch stem-diameter classes (4/32, 6/32, 8/32, 10/32, and 12/32 inch) measured 1 inch above the root collar (fig. 2). Roots were pruned to a maximum length of 10 inches before planting; damaged seedlings and very short and very tall ones were excluded from the study.

1/ Chapman, A. G. Survival and growth of various grades of shortleaf pine planting stock. Iowa State Col. Jour. Sci. 22(4): 323-331. 1948.

2/ Clark, F. Bryan, and Phares, Robert E. Graded stock means greater yields for shortleaf pine. U.S. Forest Serv. Cent. States Forest Expt. Sta. Tech. Paper 181, 5 pp. 1961.

FIGURE 1.--A cleared forest site prepared for experimental planting.

FIGURE 2.--Typical 1-0 black walnut seedlings representative of each diameter class. Scale lines are 4-inch spacing.



Direct seeding with spring-sown, stratified seed was included in the Paoli planting. There were many rodents in the planting area so a 1/2-inch-wire-mesh screen cage was used to protect the three seeds planted at each seedspot.

At Paoli seedlings of the five diameter classes and seed were planted in a 6x6 Latin square: thirty of the 36 subplots were planted with graded 1-0 seedlings and 6 subplots were planted with seed. Each subplot contained 16 seedlings or seedspots. On the other cleared forest sites seedlings of the five size classes were planted in 5x5 Latin squares. No 4/32-inch seedlings were available for the strip-mined site near Lynnville so trees of only four diameter classes were planted there. Seven, 10-tree replications of each of the four diameter classes were planted in a randomized block. All planting was done by the slit method.

2-Year Survival

Only the smallest (4/32-inch) seedlings proved to be inferior for planting on forest sites (table 1). Mean 2-year survival on the four forest sites ranged from 76 percent for the 4/32-inch class to 91 percent for the 12/32-inch class. Significant differences in survival were found between the 4/32-inch seedlings and all larger ones.

Table 1.--Average second-year survival and height of black walnut seedlings by diameter and location

Location	Diameter class									
	4/32		6/32		8/32		10/32		12/32	
	Survival	Height	Survival	Height	Survival	Height	Survival	Height	Survival	Height
	Percent	Feet	Percent	Feet	Percent	Feet	Percent	Feet	Percent	Feet
Paoli	75	1.3	84	1.2	86	1.8	90	1.9	93	2.4
Bedford	76	.9	89	1.0	96	1.4	99	1.6	95	1.8
Darlington	82	1.0	94	1.1	89	1.6	81	1.7	85	1.8
Mitchell	71	1.2	82	1.3	90	1.8	90	1.7	92	1.9
Average	76	1.1	87	1.2	90	1.6	90	1.7	91	2.0

Establishment by direct seeding was disappointing. After 2 years only 41 percent of the seedspots contained a seedling. Rodent pilferage, before and after germination, caused poor survival. Before germination the rodents dug under the wire cages for the nuts; then after the screens were removed to allow the seedlings to grow the rodents dug up the germinated seeds. There are no effective rodent repellents so, unless seedspots are protected by a more effective mechanical method, direct seeding is not recommended for areas where there are many seed-eating animals.

On the strip-mined site at Lynnville differences in second-year survival among diameter classes were even greater than in forest openings. Survival ranged from 56 percent for 6/32-inch seedlings to 93 percent for 12/32-inch seedlings.

2-Year Growth

For black walnut seedlings 2-year mean height was found to be a better indicator of seedling vigor than height growth. Planted black walnut seedlings commonly die back the first 2 years after planting and, instead of growing, many seedlings show a net loss in height.

Large diameter seedlings are tallest when planted and they retain their height advantage (table 1). Height differences among diameter classes were statistically significant at 1 percent. The rather small differences are important because the taller seedlings can compete better with volunteer vegetation.

4-Year Results at Paoli

The advantage of large seedlings extends beyond 2 years as shown by the Paoli planting which is 4 years old. Here again survival, mean height, and height growth are greatest for the larger seedlings. Fourth-year survival ranges from 66 percent for the 4/32-inch seedlings to 93 percent for the 12/32-inch seedlings. The 12/32-inch seedlings are about twice as tall and grew almost twice as fast as either the 4/32- or 6/32-inch seedlings (fig. 3).

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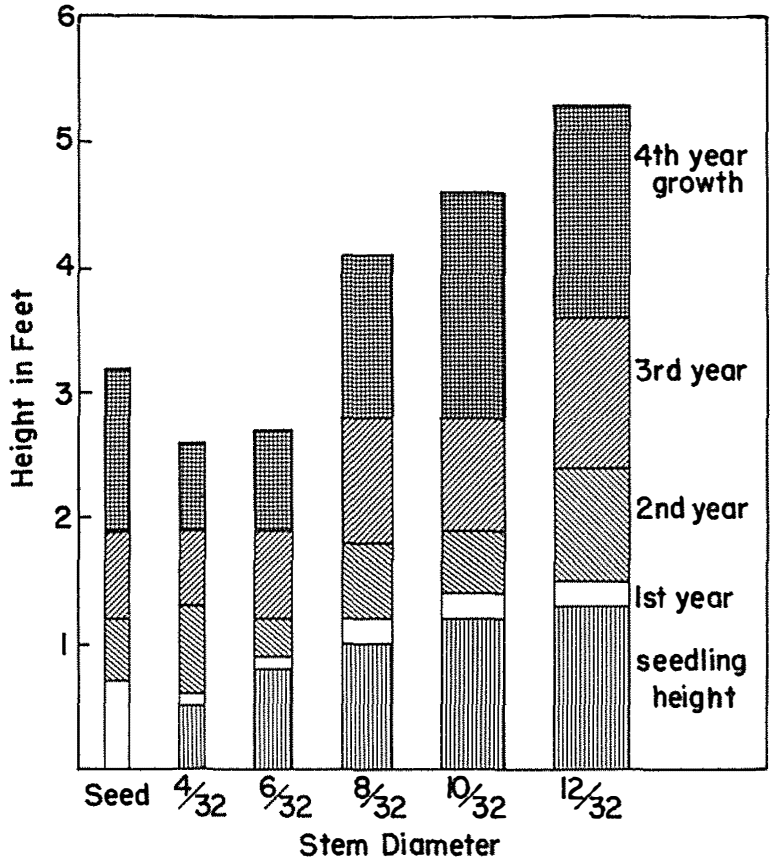

FIGURE 3.-- Four-year height and height growth by seedling diameter class (Paoli planting).

Discussion and Conclusions

Survival is the most important criterion of planting-stock quality but early growth is important too, especially on clear-cut forest sites where fast-growing weeds, brush, and trees spring up soon after cutting. Based on survival only, seedlings 5/32 of an inch and larger are acceptable. But for best survival and early growth seedlings 7/32 inch and larger--the larger the better--should be planted on forest sites. Even with good stock and adequate site preparation planted walnut may require release after the second or third growing season.

For planting on strip-mined banks large seedlings are needed. On these sites seedlings 9/32 inch or larger should be planted. Early competition is not a problem but strip-mined banks are more difficult planting sites than cleared forest land.

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